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Docket Administrator (Room 3J-219)
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EXAMINER	
CHANG, EDITH M	
ART UNIT	**PAPER NUMBER**
2637	

DATE MAILED: 12/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/938,453	HUANG ET AL.	
	Examiner	Art Unit	
	Edith M Chang	2637	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 August 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15, 17-24,29,35-39,41 and 42* is/are rejected.

7)☒ Claim(s) *16,25-28,30-34 and 40* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 August 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *040502*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because in FIG. 1 and FIG.5, the output of the FRONT-END does not produce a stream of binary numbers as described in page 5 lines 9-10 of the specification, it produces a plurality of streams as shown in FIG.1 and FIG.5.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claims 2-17, 19-41 and 44 are objected to because of the following informalities:

Claims 2-17, line 1: "The invention" is suggested changing to "the method".

Claims 19-41, line 1: "The invention" is suggested changing to "the receiver".

Claim 30, line 19 & line 22: "a joint" is suggested changing to "the joint"; line 21: "said" is suggested changing to "said discrete frequency domain".

Claim 31, it is suggested adding the definition of symbol "z" and the definition of symbol "ω".

Claim 33, it is suggested adding the definition of symbol "S" and the definition of symbol "ω".

Claim 44, it is suggested adding the definition of $\Gamma(H)^H$ and the definition of y(k). The X and X^H are not shown in the equation.

Appropriate corrections are required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 9, 10, 39 and 42 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 9 & Claim 10, lines 1-2: "said transmit antennas transmit antennas transmit" is not understood and does not clearly indicate the claim subject matter.

Claim 39, lines 2-3: "said joint minimum mean square error (MMSE) equalizer solution" lacks antecedent basis.

Claim 42, line 8: "said joint equalizer output" lacks antecedent basis.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baum et al. (US 2002/0126741 A1) in view of Odenwalder et al. (US 6,795,508 B1).

To claims 1 & 15, Baum teaches a multiple-input multiple-output (MIMO) system in FIG.1, the base stations 110 with multiple antennas sending multiple signals and receivers 130 with multiple antennas receiving the multiple transmitted signals; in FIG.2 the transmitter transmits signals d_1 to d_u over u channels (spreaded by WALSH CODE W_1 to W_u); in FIG.4 the receiver

receives the samples of the transmitted signals from 405s and detects received signals by different branches 310s. In FIG.4, the receiver comprising:

the joint equalizer, element 330 apply equalizer gain values means (page 5 section [0054] lines 1-3) that *determines* and *applies* the joint equalization solution for respective pair of the received signal transmitted over one channel (indexed by k) and the receiver branch (indexed by i) shown in equations 16 and 17 in page 5 sections [0053] and [0058] at i^{th} receiver branch and k^{th} transmitted signal wherein the H is the impulse response of the channel.

However, Baum does not explicitly specify the transmitted signals over u channels being

over u antennas. Odenwalder teaches in a CDMA system different Walsh codes used on the multiple antenna, code symbols being transmitted using one Walsh code on one antenna in FIG.1 and column 2 lines 33-38. As Baum using different Walsh codes for different channel in a CDMA communication system, it would have been obvious to a one of ordinary skill in the art at the time the invention was make to have one Walsh code channel over one antenna taught by Odenwalder in Baum's method and system for transmission and equalization for wideband CDMA for the purpose of having a improved method and apparatus for providing diversity transmissions to a receiving unit (column 1 lines 10-17).

To claim 2, Baum teaches the minimum mean square error (MMSE) solution at page 5 section [0057].

To claim 3, Baum teaches the estimating a channel for at least one paring of the transmit antenna and the receive antenna in FIG.9 step 910.

To claim 4, Baum teaches the estimating a channel for at least one paring of the transmit antenna and all receive antennas stated in page 2 section [0019] and FIG.1 wherein one base station being the transmit antenna to all user devices 120 & 130 in the region (page 5 section [0053] wherein the receiver has an M number of receive antennas). The step 910 of FIG.9 estimates a channel for at least one paring of the transmit antenna and all receive antennas.

To claim 5, Baum teaches determining the equalization solution in frequency domain in FIG.4 elements 325 and 330; and equation 10 in section [0046].

To claim 6, Baum teaches applying the equalization solution in the time domain in equation 11 in section [0048], steps 960-970 FIG.9, and FIG.4 elements 335, 340 and 345.

To claim 7, Baum teaches applying the equalization solution performed in the frequency domain in FIG.4 elements 325 and 330 to the received samples.

To claim 8, Baum teaches dispreading the equalized signals by spreader 345 of FIG.4.

To claim 9, the modified/combined Baum method with Odenwalder's teaching teaches at least two of the transmit antennas transmit at different carriers (column 2 lines 22-25).

To claim 10, Baum teaches using different transmit constellations, e.g. QAM or PSK in section [0020].

7. Claims 11-14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baum et al. (US 2002/0126741 A1) in view of Odenwalder et al. (US 6,795,508 B1) as applied to claim 1 above, and further in view of Yakhnich et al. (US 6,731,700 B1).

To claim 11, Baum does not specify the soft bit mapper of a decoder. Yakhnich teaches a decoder with the soft value generator/mapper in FIG.2 and FIG.5 and the posteriori probability algorithm (column 11 lines 17-25). As Baum dispreading the received coded wireless signal, and Yakhnich teaching decoding the despreaded signal from the demodulator, it would have been obvious to a one of ordinary skill in the art at the time the invention was make to have the decoder with the soft value generator taught by Yakhnich (elements 58 and 60 of FIG.2) in Baum's receiver to receive the despreaded data 350 of FIG.3 to decode the coded signal to recover the transmitted signal for the purpose of having an efficient decoding with the soft decision information independent of the type of equalizer (column 5 lines 44-52).

To claim 12, Baum teaches dispreading the equalized signals by spreader 345 of FIG.4.

To claim 13, the modified Baum method with Yakhnich's teaching teaches making the noise equal as the zero means white noise in the posteriori probability's soft mapping in column 12 lines 20-30 ('700).

To claim 14, the modified Baum method with Yakhnich's teaching teaches performing a posteriori probability metric (column 10 lines 66-67 & column 11 lines 17-25) on the samples from the inner decoder/equalizer (column 2 lines 27-30).

To claim 17, the modified Baum method with Yakhnich's teaching teaches to minimize the ISI as the equalizer solution in column 2 lines 25-30 of Yakhnich '700.

8. Claims 18-24, 29, 35-39, 41 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baum et al. (US 2002/0126741 A1) in view of Yakhnich et al. (US 6,731,700 B1) and Odenwalder et al. (US 6,795,508 B1).

To claims 18 & 42, Baum teaches a multiple-input multiple-output (MIMO) system in FIG.1, the base stations 110 with multiple antennas sending multiple signals and receivers 130 with multiple antennas receiving the multiple transmitted signals; in FIG.2 the transmitter transmits signals d_1 to d_u over u channels (spreaded by WALSH CODE W_1 to W_u) in FIG.4, the receiver detects received signals by different branches. In FIG.4, the receiver comprising:

the joint equalizer, element 330 apply equalizer gain values means (page 5 section [0054] lines 1-3) that develops a joint equalization solution for respective pair of the received signal transmitted over one channel (indexed by k) and the receiver branch or antennas (page 5 section [0053], indexed by i) shown in equations 16 and 17 in page 5 sections [0053] and [0058] at i^{th} receiver branch and k^{th} transmitted signal as an order control in page 8 section [0092] lines 5-9.

However, Baum does not specify the decoder. Yakhnich teaches the decoder with the soft value generator in FIG.2 and FIG.5 and the posteriori probability algorithm (column 11 lines 17-25). As Baum dispreading the received coded wireless signal, and Yakhnich teaching decoding the despreaded signal from the demodulator, it would have been obvious to a one of ordinary skill in the art at the time the invention was make to have the decoder with the soft value generator taught by Yakhnich (elements 58 and 60 of FIG.2) in Baum's receiver to receive the despread data 350 of FIG.3 to decode the coded signal to recover the transmitted signal for the purpose of having an efficient decoding with the soft decision information independent of the type of equalizer (column 5 lines 44-52).

And Baum does not explicitly specify the transmitted signals over u channels being over u antennas, it is well known that the in a CDMA system different Walsh codes used on the multiple antenna, code symbols being transmitted using one Walsh code on one antenna as taught by Odenwalder in FIG.1 and column 2 lines 33-38. As Baum using different Walsh codes for different channel in a CDMA communication system, it would have been obvious to a one of ordinary skill in the art at the time the invention was make to have one Walsh code channel over one antenna taught by Odenwalder in Baum's method and system for transmission and equalization for wideband CDMA for the purpose of having a improved method and apparatus for providing diversity transmissions to a receiving unit (column 1 lines 10-17).

To claim 19, Baum teaches the minimum mean square error (MMSE) solution at page 5 section [0057].

To claim 20, the modified Baum method with Yakhnich's teaching teaches performing a posteriori probability metric (column 10 lines 66-67 & column 11 lines 17-25) on the samples from the inner decoder/equalizer (column 2 lines 27-30).

To claim 21, the modified Baum method with Yakhnich's teaching teaches making the noise equal as the zero means white noise in the posteriori probability's soft mapping in column 12 lines 20-30 ('700).

To claim 22, Baum teaches dispreading the equalized signals by spreader 345 of FIG.4.

To claim 23, the modified/combined Baum method with Odenwalder's teaching teaches at least two of the transmit antennas transmit at different carriers (column 2 lines 22-25).

To claim 24, Baum teaches using different transmit constellations, e.g. QAM or PSK in section [0020].

To claim 29, Baum teaches that the joint equalizer, element 330 apply equalizer gain values means (page 5 section [0054] lines 1-3) develops a joint equalization solution for respective pair of the received signal transmitted over one channel (indexed by k) and the receiver branch (indexed by i) shown in equations 16 and 17 in page 5 sections [0053] and [0058] at i^{th} receiver branch and k^{th} transmitted signal as an order control in page 8 section [0092] lines 5-9, wherein the M receive elements as different signal detectors.

To claim 35, the modified/combined Baum's receiver with Odenwalder' teaching teaches that the signal sources and detectors are antennas.

To claim 36, Baum teaches the estimating a channel for each paring of the transmit antenna and the receive antenna in FIG.9 step 910 and page 8 section [0092].

To claim 37, Baum teaches the equalizer having the equalization solution in frequency domain in FIG.4 elements 325 and 330; and equation 10 in section [0046].

To claim 38, Baum teaches the equalizer having the equalization solution in the time domain in equation 11 in section [0048], steps 960-970 FIG.9, and FIG.4 elements 335, 340 and 345.

To claim 39, Baum teaches developing and applying the equalization solution in a frequency domain in FIG.4 elements 325 and 330; and applying the obtained MMSE solution in the time domain in FIG.4 elements 335, 340 and 345.

To claim 41, the modified Baum method with Yakhnich's teaching teaches to minimize the ISI as the equalizer solution in column 2 lines 25-30 of Yakhnich '700.

Allowable Subject Matter

9. Claims 16, 25-28, 30-34 and 40 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and overcome the objections listed in paragraph 1 of this office action.

10. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record fails to teach or suggest, alone or in a combination, among other things, at least a receiver used in MIMO system for compensating for time dispersion and its method as a whole, the combination of elements and features, which includes a buffer-subtractor coupled between the joint equalizer and the space time regenerator to subtract a representation of

signals for a currently being processed transmit antenna from the samples received; two plurality of fast Fourier transform processors in the joint equalizer arranged as recited in the claims.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edith M Chang whose telephone number is 571-272-3041. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jayanti Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Edith Chang
December 7, 2004

YOUNG T. TSE
PRIMARY EXAMINER